

1. (15 %) Explain the terminologies generally used in microelectronics:

- (a) FPGA
- (b) GaAs IC
- (c) ASIC
- (d) HDL (hardware description language)
- (e) Cell library

2. (15 %) (a) Please draw an operational amplifier circuit of precision full-wave rectifier circuit and its transfer characteristics of input/output signals.

(b) Please input a sinusoidal waveform of 1 Hz and draw the output signal. (Note: please label appropriately for your drawings.)

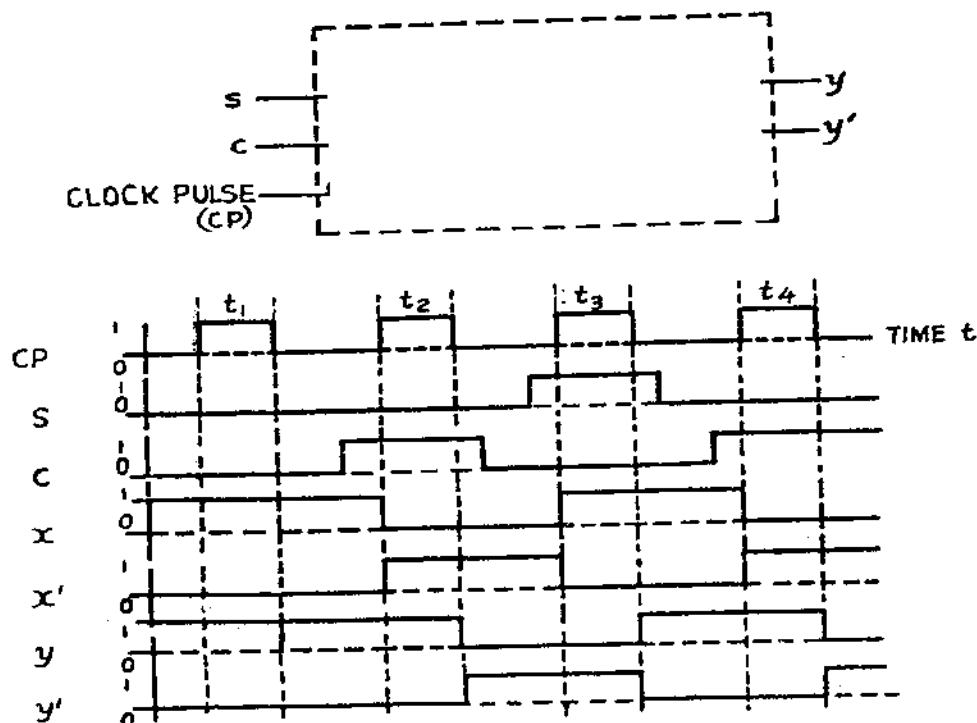
(c) Repeat (a) and (b) for a precision half-wave rectifier.

3. (15%) Please design a Colpitts or Hartley Oscillator with oscillation frequency at 100 KHz. Draw the circuitry and label the values of Cs and Ls.

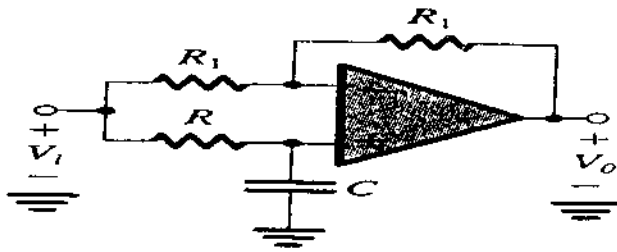
4. (15%) (a) Please complete the digital circuit using flip-flops with timing diagram shown in figure 1. (Note that x' is the inversion of x)

(b) Derive the state table of the circuit.

(Figure 1)



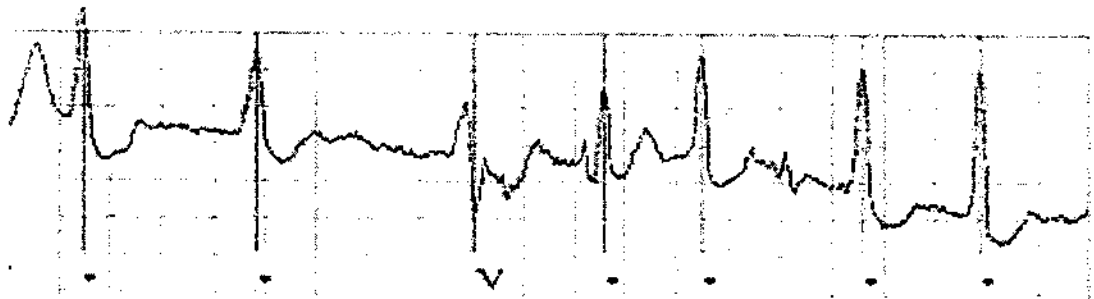
(背面仍有題目,請繼續作答)



(Figure 2.)

5. (20 %) Please derive (a) the transfer function $T(s)$, (b) zero pole positions, (c) magnitude and phase spectra, and (d) identify the type of filter shown in Figure 2.

6. (20 %) Figure 3 is a trace of ECG, signal from heart beats. The peak of each ECG is called R wave. The physician in NCKU Hospital wishes to design electronics circuit to determine the R-R interval, the time between two R waves at a resolution of ms. Please use anything you learned in your undergraduate study (e.g. microprocessor, peak detector, timer, or filters) to complete this project and describe your design criteria and considerations.



(Figure 3).